DOCUMENT RESUME

ED 227 578 EA 015 501

AUTHOR Bock, Larry T.
TITLE Energy Management through Use of a Load Programmer.
PUB DATE Nov 82
NOTE 11p.; Paper presented at the Annual Meeting of the Association of School Business Officials (Atlanta, GA, November 2-6, 1982).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Climate Control; Computer Oriented Programs; Educational Facilities; *Electrical Systems; *Energy Conservation; Fuel Consumption; Heating; Secondary Education
IDENTIFIERS *Load Demand Control; Nebraska

ABSTRACT

As the first step in a district energy conservation program, the Blair (Nebraska) Community School District installed a load programmer in 1980 to control power usage in the 144,000 square foot junior-senior high school. The cost of the load programmer was less that $8,500, including installation, and during the initial year of operation, the computer-controlled equipment enabled the district to decrease its annual expenditure for power by $10,000. The load programmer was designed to permit variable day and night control, demand control, duty cycling, and the programming of units to a "day" mode as required. This document reports on the factors in the technology selection process, and on the characteristics of the system, as well as providing a brief analysis of the effectiveness of the installation. (PGD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED227578

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Larry T. Bock

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ENERGY MANAGEMENT THROUGH USE OF A LOAD PROGRAMMER

Larry T. Bock

Paper presented at the Annual Meeting of the Association of School Business Officials (Atlanta, GA, November 2-6, 1982).

EA 015 501

ENERGY MANAGEMENT THROUGH USE OF A LOAD PROGRAMMER

Blair Community School District is a district serving approximately 1850 students. We are located in a farming community 18 miles north of Omaha situated along the Missouri River. As we entered the heating season in 1978, consideration was given to investigating improvements or alternatives to help combat the rising cost of energy. The first step in decision making in energy efficiency needs to be "discover where you are."

An investigation into energy usage and where the greatest waste is occurring can be done in many ways. We relied on several sources for initial information. At that time the University of Nebraska - through their engineering program - provided a free energy analysis of your school building by one of the advanced engineering classes. We also received help from companies with whom we had service contracts, as well as representatives from local utilities. One source of free information I would recommend is a paperback workbook entitled Energy Conservation With Comfort which was put together and is distributed by Honeywell. (You can obtain a free copy of this book by contacting the Honeywell office that services your area.) This book contains excellent information on the various considerations that should be given to an energy conservation project.

After spending much time on analysis of our district, it was decided to first control electrical usage at the Junior-Senior High School. The Junior-Senior High School is a one level building of approximately 144,000 square feet. Twelve Lennox roof-top heating and cooling units provide climate control for that building. Considering dollars and cents of our energy usage, one of the largest expenditures was electricity at this facility. Technology has developed sufficiently

EA 015 501

such that efficiently designed hardware is available to control such a problem.

Once the decision was made to control the electric usage in the Junior-Senior High School building, the next matter to be solved was "What do we actually want to accomplish?" The following problems emerged as the greatest causes for our high electric usage. First, our present system was rather inflexible in the area of day-night control. We did have a time clock which would "kick" units from day control to a night thermostat control, but it offered no flexibility. Secondly, we needed to reduce the tremendous kilowatt rating that had been established as the electrical demand. The next area was that of cycling units during the school day. Obviously, it was not practical to manually switch units on and off to insure even load distribution throughout the day. The last major problem to be solved was a means to program the units so that some or all could be activated to respond to special scheduling such as Adult night classes. With the original controls, either the building had to remain on night stat during Adult Education classes, or all units had to be switched on and individual units shut down while the areas being used were serviced. During very cold weather, all units ran to insure against freeze up.

Summarizing, we needed hardware to accomplish the following functions:

1. Day-night control
2. Demand control
3. Duty cycling
4. Ability to program units to a "day" mode

Technology offered computer memory and compatible hardware to provide proper control to satisfy our needs. Three basic systems were available

to provide the service we needed.

1. Computers on time shared leased line basis.
2. An in house computer system hooked up to a mini computer.
3. A load programmer

Time shared leased line computer access provides an abundance of computer memory for the user. The benefits of such a service are in the flexibility provided by such a service. Its limitations are cost and complexity.

An in house computer system with a mini computer eleiminates the disadvantage of the leased line while preserving many of the advantages. A simple diagram (Diagram 1) of a memory chip shows that when enough memory is available many decisions can be made by the computer. As an example, if one were air conditioning a building using a large computer, you could consider time, temperature and humidity in deciding whether a unit needs to be running or shut down. Two of the inputs shown on the diagram would be monitoring the chilled water, one monitoring the supply, and one monitoring the return. Another set of lines could monitor the temperature - one for the outside temperature and the second for the inside temperature. A third set of lines could monitor the humidity, one for the outdoor himidity and one for the humidity inside. Therefore, this computer can take analoge data and respond to whatever combination of factors are necessary for the environment you are trying to control. In a hospital, as an example, the humidity and continual change in temperature could be extremely important - especially in areas where bronchial dis-orders are being treated. Sophistication of a system like this was not necessary for

our purposes in dealing with the climate control in our high school building. Therefore, the most attractive of the three options was the Load Programmer.

At this point we contacted representatives from companies which sold load programmers. Engineers from Honeywell did an energy study of our building and presented a proposed solution for our problem.

It was proposed that we install a Basic 8 Load Programmer which is manufactured by Pacific Technology Incorporated. The initial proposal was for $8,355.99 installed. This programmer was to provide the following services:

1. Establish a peak demand for Blair Junior-Senior High School electrical usage - this demand was set at two-thirds of the current demand.
2. Rotate loads through a scanning cycle according to a pre-determined priority listing. This scanning cycle controls all fans and has a shut-off of 10 minutes out of every 30. Our maintenance man, high school principal, myself, and the Honeywell representative did a study of the high school facility to determine which loads were priority loads and needed priority response, and which areas of the building were areas that could handle a slower response to a climate control request.
3. Thirdly, due to evening usage of certain portions of our building, it was advantageous for us to use the computer to override the night stat for these rooms.

Our school board approved the proposal at their July, 1980, board meeting and installation began in November of 1980. Shown on Chart I is an analysis of the monthly electrical usage for the Junior-Senior High School building. During the first few months of operation a slight improvement was noticed as the system was being installed. As more of the system became operative, a greater amount of energy was saved. The system was completed and in full operation in the month of January 1981.

Chart I was provided by Honeywell through the use of a comparative analysis of our costs. This comparative analysis takes into account the actual temperatures that occurred on each day of the years being compared. Notice that our average month's utility cost avoidance was $788.47. Also notice that the actual pay-back on our Load Programmer took but 11½ months. The estimated pay-back of 36 months was presented to our School Board in July of 1980. As you can see, the actual pay-back was even better than original engineering figures.

Today our Load Programmer is continuing to give us the service we originally requested plus more benefits than we had anticipated. Chart II shows usage from September 1980-81 and compares with usage in 1978-79 - two years back! Notice the difference beginning in November when the first hook-up was completed. We are currently considering lowering the demand setting another 15%, - which would establish our demand at half of what it was prior to the installation of the Load Programmer.

As for the future, the Load Programmer we currently are using has been surpassed in technology, and load programmers currently on the market can do what our Basic 8 has done plus much more. Micro Processors

not only provide functions we requested, but also have capability of controlling water heaters, disposal, compactor, refrigeration equipment, outside lighting, interior lighting, and other motors not related to heating and cooling. All companies have continued to improve their basic technology. If you have a need for control of electric usage in any of your school buildings, my recommendation would be to contact several companies and obtain information on hardware available as well as the service that is available. Define which functions you need to control, and then decide which vendor has the best product at the best price. Obviously, this is one decision which was made by our District that has paid excellent dividends, reducing our annual budget by approximately $10,000.

CHART II

	1978-79		1980-81	
	KW	Cost	KW	COST
September	117,840	3,180	114,480	4,295
October	90,480	2,432	93,600	3,353
November	92,400	2,476	74,400	2,683
December	86,640	2,430	78,240	2,720
January	97,680	2,891	91,680	3,110
February	101,280	2,984	82,560	2,845
March	99,600	2,940	78,960	2,820
May	102,720	3,090	56,880	2,214

BLAIR HIGH SCHOOL

BUILDING DATA:

- Eleven years old
- One level, 144,000 square feet
- 12 Lennox rooftop heating-cooling units

APPLICATION:

- Demand control
- Duty cycling
- Time of day programming
- Temperature control maintenance

ENERGY CONSUMPTION HISTORY:

- Time period - 9 months
  December 1979 thru August 1980 - Base
  December 1980 thru August 1981 - Current
- Base period consumption
  - Electricity . . . . . 812,880 KWH
  - Gas . . . . . 74,787 CCF
- Current period consumption
  - Electricity . . . . . 650,640 KWH
  - Gas . . . . . 61,662 CCF
- KWH Consumption avoidance . . . 162,240
- CCF Consumption avoidance . . . 13,125

ENERGY SAVINGS SUMMARY:

- Average monthly utility cost avoidance . . . . . $ 788.47
- Actual avoidance in utility costs over the nine month period . . . . . $ 7,096.26

- Initial Honeywell estimate of savings . . . . . $ 2,189.01

RETURN ON INVESTMENTS:

- Estimated payback . . . . . 36 months
- Actual payback . . . . . 11½ months

CHART I

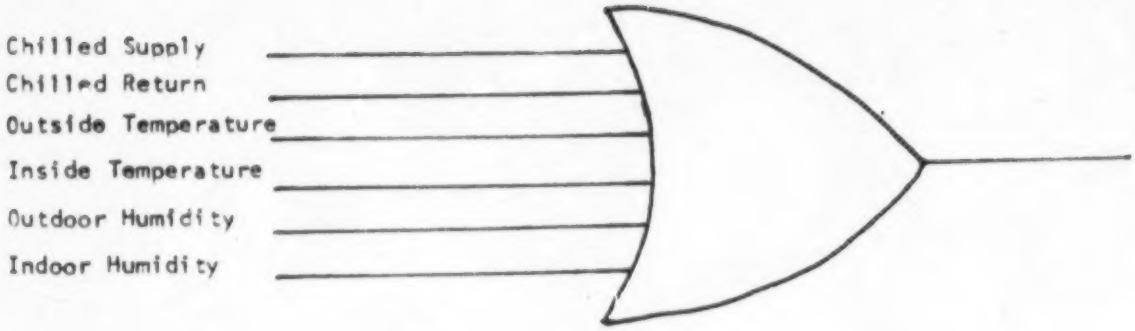
Chilled Supply
Chilled Return
Outside Temperature
Inside Temperature
Outdoor Humidity
Indoor Humidity

DIAGRAM I